

# THE ANATOMY OF A HIGH-TECH BICYCLE

By Steven K. Roberts - KA8OVA  
Reprinted with permission.

[Ed: Steve Roberts' adventures on the road can be read through the GENie Network. His email address on GENie is WORDY.]

I received a number of questions about the various systems that make the Winnebiko what it is, and this menu choice is designed to provide a brief technical overview of this complex machine. For background on the trip itself, select the library of stories.

Here, in no particular order, are the components of my electronic cottage on wheels:

My main computer is the Hewlett-Packard Portable PLUS, an exquisite system with 896K of memory partitioned between system RAM and electronic disk. The high-contrast amber LCD displays 25 lines of 80 characters, and a built-in 1200 baud modem makes the daily GENie check-ins easy. But what really sells the machine are the applications software packages baked into ROM: Microsoft WORD, Lotus 1-2-3, dbase II, a "card-manager" filing system, communications software, time manager, and a whole library of utilities. The net effect is a robust bicycle business system that runs on rechargeable batteries and weighs 8 pounds -- a system that has become so much a part of my daily reality that I'm incapable of imagining nomadic life without it. It rides behind me, nestled in foam along with a 3.5-inch disk drive, sometimes accepting charge current from the bike's solar panels.

Computer number two, built into the control console, was once a Radio Shack Model 100 -- upgraded to 256K and made truly useful through the addition of Traveling Software's Ultimate ROM. But the machine is now hardly recognizable: its keyboard and case are gone, and the display appears on the bike's front panel behind a lexan window. What happened to the keyboard? It has been replaced by custom logic that passes converted handlebar keycodes or software-generated commands. This system is intended for on-the-road text capture (not final

editing), and thus connects with the HP via a front-panel RS-232 connector.

The third system is the "bicycle control processor" (BCP), based on a 32K Motorola 68HC11 board. This low-power machine embodies all of the bike's real-time control and monitoring functions, including handlebar keyboard code conversion, local network control (linking the other systems with each other), electronic compass processing, control of solar battery charging, security system supervision, diagnostics, status display, and so on. Assisted by about 50 IC's, this processor essentially runs the bicycle.

Computer number 4 is a speech synthesizer that speaks any text file transferred to it. The value of this on the bike is threefold: I can have the system read back my own text or incoming messages, and it is a handy way to reduce the volume of identical questions from curious bystanders. ("I am the Winnebiko," it says, either at predefined intervals or under radio control, going on to explain the basics of this strange contraption). The speech board can also respond to a security alert by saying "Please do not touch me!" in a robotically threatening voice.

For every type of  
printing you need.

And a variety of  
special services, too.

Brochures  
Letterheads  
Stationery  
Envelopes  
Announcements  
Flyers  
Business Cards

Pamphlets  
Price Lists  
Business & Legal Forms  
Booklets  
Memo Pads  
Labels  
Menus



32 Railroad Square  
Nashua, N.H. 03060  
(603) 883-4890



THE WORLD'S BEST COFFEE & DONUTS

Mister  
Donut

MULTIPODE

Also available:  
Pastries, pies and  
cakes for all your  
holiday needs.

We accept orders for all occasions

300 MAIN STREET, NASHUA, NH 03060  
1-603-883-9443

The fifth system is known as a "terminal node controller" -- a Pac-comm product that handles packet data communication via radio. An unusual breed of computer network has quietly appeared in the last 2-3 years, a sort of digital anarchy of the airwaves, a computer network without corporate substrate. Anybody with a ham radio license and a bit of equipment can participate -- sending mail cross-country, transferring files, conferencing, and so on. The network is young, but already offers coast-to-coast trunk connections, automatic message forwarding, dozens of linked bulletin board systems, and its own orbiting satellite mailbox. With packet operation possible from the bicycle via the handlebar keyboard and LCD display, I can communicate data from a campground or while pedaling. Ain't technology wonderful?

The handlebar keyboard itself is simple: four pushbutton switches are buried in each foam grip, spaced about .75" apart. I type in a binary code, sort of an ASCII with decoded zone bits: my five strongest fingers, three on the right and two on the left, produce the lower-case alphabet; the right little finger capitalizes. The left little finger is the control key, its neighbor selects numeric and special keys, and those two together cause the others to take on system level meanings such as file operations and major edit functions. In practice, it's easy -- a lot like playing the flute -- with each combination accepted by the system when all buttons are released.

(continued next month)

[illegible]

PODUNK WEEKEND -- AUGUST 1-2

The club's annual Podunk, VT outing will be held on the weekend of August 1 and 2, 1987. Overnight space for campers is by RESERVATION ONLY. Please, as a courtesy to the host and hostess (WB1BRE and KA1LDS), tell them if you are going for the day events only.

[illegible]

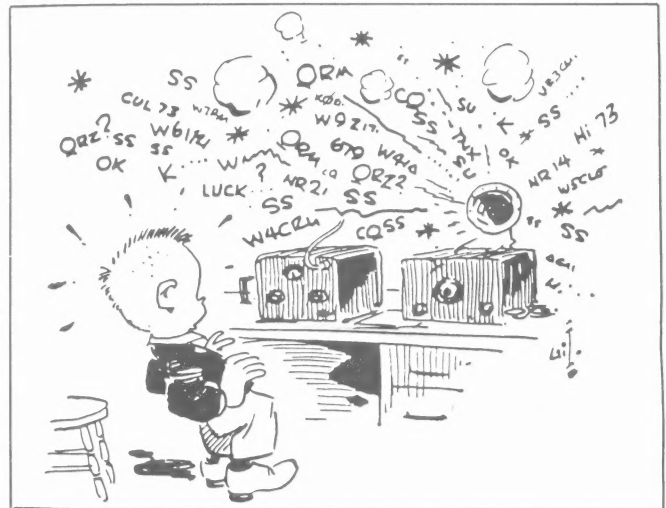
The Salkraft Workshop

### *Chairs Caned, Refinished and Repaired*

BOB HALBERT

1-603-888-3086

```
*****
Looking to transfer files between
computers that don't like to talk to
each other? The June issue of PC
Resource magazine has an article
called "File Transfers Across the
Great Divide". It covers, among
other things, ports, modems, RS-232C,
commercial solutions (including C128
to IBM/MS-DOS), and converting text
files to ASCII. It's written in
plain English, so you don't have to
be a hacker to understand it.
*****
```



Reprinted from QST, March, 1959

Used by permission.

DON'T FORGET -- if you've recently upgraded or changed your address, phone number, etc., please let club data base manager Dan Vaillancourt, K10SM, know so he can update your record in the data base.

\*\*\*\*\*

**MDL** SECURITY  
SYSTEMS, INC.

**Michael D. Lemieux**  
President

16 CIMMARRON DRIVE  
NASHUA, NH 03062

**(603) 883-0991**

# THE ANATOMY OF A HIGH-TECH BICYCLE

by Steven K. Roberts - KA8OVA  
Reprinted with permission.

(Part 2)

The mobile ham radio station (KA8OVA here) is a multimode 2-meter rig from Yaesu. In addition to handling data communication, it allows me to stay in regular voice contact with Maggie (my recumbent-borne traveling companion). Bicycle touring without some form of communication is frustrating, as anyone who has ever squinted into the mirror for minutes at a time well knows. "What happened to him? Is he OK back there?" With a boom microphone built into my helmet and a push-to-talk switch on the handlebars, Maggie is never far away (effective bike-to-bike simplex SSB radio range is over 2 miles). Of course, having 2-meter FM capability on the bike also connects me to a huge network of ham radio operators: I store the local repeater frequencies into the radio's memory as I approach an area, and periodically identify myself as an incoming bicycle mobile. This has led to a number of interesting encounters and places to stay. And -- through the repeaters -- I can make telephone calls directly from the bike.

CB radio is also on board, culturally useless by comparison, but still handy enough to justify its weight. I can talk to truckers, hail a passing motorhome for water (this saved my life in Utah), and chuckle at the residual good buddy subculture that still hangs on long after the death of the great CB boom.

System security is an issue when living on a machine that looks like something from NASA. It's not that people try to steal it -- most are intimidated by the technology -- it's just that some let their curiosity extend to flipping switches and tinkering. To alert me to such behavior, I built in a security system (based on the UNGO box) with vibration and motion sensors; when armed by a front-panel keyswitch, any disturbance causes transmission of a tone-encoded signal that sets off my pocket beeper up to 2-3 miles away. Maggie's bike has a motion

sensor also, and plugs into a front-panel jack when the two machines are parked side-by-side.

Other radio-related devices include a digital shortwave receiver, a Sony Watchman micro-TV, a VHF weather radio, and an FM stereo. Naturally, there is also an audio cassette deck, for sometimes it takes more than a granny gear to climb a mountain...

Speaking of gearing, the bike is equipped with some unusual mechanical hardware. A custom 36-speed crossover system of 3 derailleurs provides a 16.9-inch granny gear, a 23-inch "high granny," and half-step from 33 to 144. With the Zipper fairing and the recumbent's aerodynamic advantage, I can cruise comfortably at 15-17 mph (assuming a good breakfast and no unfriendly winds). Peak speed so far, flying down a mountain, was 58.1.

Stopping power is critical with my 480-pound gross weight, of course. Moving that much stuff downhill at 50 miles an hour is profoundly exhilarating... but stopping is another matter. The Winnebiko II has three brakes: a Phil Wood disc actuated by my left hand and a pair of Wathausser hydraulics controlled by the right. The disc is nice for speed regulation without rim heating effects; the hydraulics will stop anything, dramatically outperforming the various mechanical models I have tried and discarded over the years. To control them with a single lever, I machined a header for the master cylinders, with a sliding cable stop and proportional transfer bar to permit a variable front-back braking force ratio.

The frame itself was custom made by Franklin Frames of Columbus, Ohio -- after I did enough brazing in my basement to convince myself that framebuilding is an art form. The geometry is entirely custom, suited to my giraffe body and the special requirements of all this on-board hardware.



LARSEN ANTENNAS --  
25% OFF  
INSTALLATION - \$30

BELTRONICS, INC.

2-WAY RADIO EQUIPMENT SYSTEMS  
PAGERS • MOBILE • PORTABLES  
BUSINESS • POLICE • FIRE • IN-PLANT  
ENCODERS • DIALERS • TONE SYSTEMS

JIM BELANGER  
PHONE 603 465-2422

19 PROCTOR HILL RD.  
HOLLIS, N.H. 03049

The Halkraft Workshop

Chairs Caned, Refinished  
and Repaired

BOB HALBERT

1-603-888-3086

Power for the electronic systems is derived from a pair of Solarex photovoltaic panels, producing 20 watts in full sun (roughly 1.3 amps total into the pair of 4 amp-hour batteries). These new SX-LITE units lack the traditional glass and aluminum frame, and are each 12.5 X 17 inches. Since they can pump enough current into the Ni-Cads to overcharge them, I have built in extensive power monitoring and control circuitry: A digital panel meter with a thumbwheel switch can show instantaneous current into or out of each battery (as well as any system voltage), and the BCP can throttle back the charging process if its calculations indicate that the batteries are full (% charge values are displayed on the console).

Other voltages besides the two 12-volt battery buses are needed throughout the system, and this is one of those areas that can cause significant overhead if attention isn't paid to losses. There is a small aluminum box containing LI1870-based switching supplies that coolly provide 3, 5, 6, 9, and -12 volts (all available on the front panel for external accessories). Considering the special requirements of a bicycle system, the extra design effort here has paid off well: when the two processors required for bike monitoring and text editing are active, total system current drain is only 130 milliamps. A sixth power supply, unrelated to the others, is mounted up front with a coiled cord to allow battery charging if I have gone too long without sunshine.

Instrumentation on the front panel is largely geared to the major electronic systems already described, but there is also the obligatory Cat-Eye Solar to display speed, distance, cadence, and so on. This elicits interesting comments from fellow bikies, who stare at the machine in awe then suddenly recognize something familiar. In addition, there is an altimeter (useful on mountains, and also helpful in predicting weather conditions), an Etak electronic compass, time/temperature display, and assorted system status indicators.

Mechanically, the electronics package is designed to separate from the bike with a minimum of effort. I open 3 toggle clamps, unplug 6 waterproof connectors, and take it into the tent at night, yielding a "tent control system" just as useful as the mobile variety. The 48-pound unit handles heavy downpours with no problem -- with the fairing and velcro-on waterproof covers, it has withstood all-day rides that quite saturated my Gore-tex. So far, the system has suffered shock and vibration without incident, unfolding easily for service but surviving heavy abuse on the road.

Safety factors are always a major concern when you habitually press your luck by living fulltime

alongside logging trucks, drunks, motorhomes, and the routine madness of the highway. I have become a firm believer in helmets, reflectors, orange flags, and GOOD lights. Bicycle Lighting Systems offers a line of industrial-grade products that quite outshine the typical bike lights; I went with a 7-inch yellow barricade flasher that makes me look like a roving hole in the road, a 2-inch red taillight, and a 4-inch sealed-beam headlight. In addition, I have recently added a Cycle-Ops halogen helmet light, which has the delightful characteristic of putting light where I'm LOOKING, not just where the bike happens to be pointing. (Admit it. You too have zigzagged drunkenly through neighborhoods at night, trying to highlight street and house number signs...)

Finally, the machine is equipped with all the usual bicycle touring gear: stove, food, clothing, tools, candles, medical supplies, microfiche documentation library, flute, binoculars, camera, maps, digital test equipment, spare inner tubes, frisbee, coffeemaker, office supplies, butane soldering iron, and so on. My tent is a vast "Peak Pod 4" from Peak 1, very much in the porta-condo class at 188 square feet under cover. Other outdoor gear -- North Face down bags, Gore-tex rainsuit, Patagonia hunting, polypro underwear, and so on -- is undergoing constant revision as fabric technologies continue to improve.

There... a marathon overview of the Winnebiko. If any of this seems insane, think about gravity and how long I would continue to drag around something that isn't practical (and, preferably, multifunctional). This whole adventure is a wild blend of serious business and fun -- a case of personal computers and technology carried to an exquisitely mad extreme.

Thanks to all who helped make it possible!

## STOLEN:

YAESU FT 109 RH  
220 MHz Handheld, S/N 6M010094  
Stolen from KA1OKQ's QTH on June 5, 1987

## NEW ADDRESS FOR FCC REGIONAL OFFICE:

NFPA Building  
Batterymarch Park  
Quincy, MA 02169  
Telephone:

Recording # (617) 770-3922  
Public # (617) 770-4023